

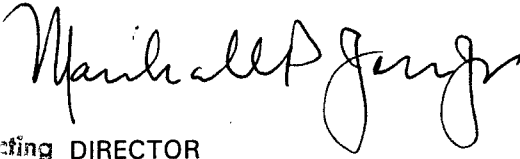


U.S. FISH AND WILDLIFE SERVICE TRANSMITTAL SHEET

PART	SUBJECT	RELEASE NUMBER
241 FW 3, 6, and 8	Safety Operations	442
FOR FURTHER INFORMATION CONTACT Division of Safety and Health	Personal Protective Equipment Electrofishing Energy Lockout/Tagout Program	DATE March 19, 2004

EXPLANATION OF MATERIAL TRANSMITTED:

241 FW 3 establishes policy and procedures for providing clothing and equipment that protects employees from hazards that may be encountered while performing their jobs. 241 FW 6 establishes requirements for the safe conduct of electrofishing. 241 FW 8 outlines the requirements and responsibilities for controlling the unintentional release of hazardous energy that could cause injury or damage while machines and equipment are being maintained and/or serviced.


Acting DIRECTOR

FILING INSTRUCTIONS:

Remove:

241 FW 3, 03/24/92, FWM 018
None
Appendix 1, 241 FW 3, 03/24/92, FWM 018
Appendix 3, 241 FW 3, 03/24/92, FWM 018
Appendix 2, 241 FW 3, 03/24/92, FWM 018
Appendix 4, 241 FW 3, 03/24/92, FWM 018
Exhibit 1, 241 FW 3, 03/24/92, FWM 018

241 FW 6, 10/12/92, FWM 036
Exhibit 1, 241 FW 6, 10/12/92, FWM 036

241 FW 8, 10/12/92, FWM 037

Insert:

241 FW 3, 03/19/04, FWM 442
Exhibit 1, 241 FW 3, 03/19/04, FWM 442
Exhibit 2, 241 FW 3, 03/19/04, FWM 442
Exhibit 3, 241 FW 3, 03/19/04, FWM 442
Exhibit 4, 241 FW 3, 03/19/04, FWM 442
None
None

241 FW 6, 03/19/04, FWM 442
None

241 FW 8, 03/19/04, FWM 442

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OCCUPATIONAL SAFETY AND HEALTH**

Occupational Safety and Health

Part 241 Safety Operations

Chapter 6 Electrofishing

241 FW 6

6.1 What is the purpose of this chapter? This chapter establishes Fish and Wildlife (Service) requirements for the safe conduct of electrofishing. It provides guidelines for the safe operation, construction, and modification of electrofishing equipment.

6.2 Who does this chapter apply to? This chapter applies to all Service personnel (permanent, temporary, volunteers) who use electricity to sample or control animals in aquatic habitats.

6.3 What are the authorities for this policy?

A. 29 CFR 1910.

B. Federal Boat Safety Act of 1971 as amended (46 U.S.C. 1451-89).

C. National Fire Protection Association (NFPA) 70-1999, National Electric Code (NEC).

D. 485 DM 22.

6.4 Who is responsible for ensuring compliance with the electrofishing policy?

A. Regional Directors and Manager, California/Nevada Operations Office (CNO) are responsible for ensuring that electrofishing operations are conducted safely and that sufficient resources are allocated to accomplish this. **Supervisors** must adhere to the safety standards contained in this chapter, as a minimum.

B. The National Conservation Training Center (NCTC) is responsible for:

(1) Preparing electrofishing examinations for persons desiring to demonstrate knowledge of the principles and techniques of electrofishing by satisfactory completion of a certifying examination.

(2) Ensuring sufficient scheduling of the course, *Principles and Techniques of Electrofishing*.

(3) Issuing course completion certificates for individuals completing the course examination.

(4) Maintaining records of participants who have successfully completed the electrofishing course.

(5) Providing safety training materials for crew member training.

C. Electrofishing Team Leader. As the onsite individual in charge of electrofishing operations, the team leader is responsible for:

(1) Identifying hazardous conditions associated with proposed electrofishing operations, determining measures to protect electrofishing team members, and appropriately briefing team members (paragraph 6.6C).

(2) Maintaining all electrofishing equipment in a safe condition. Visually inspecting all external wiring, cables, and connectors for physical damage before each use. Any equipment deficiency that may present a safety hazard will be corrected before each field operation or when equipment damage occurs during actual use.

(3) Ensuring that employees follow proper safety procedures and utilize the proper safety equipment.

(4) Ensuring that adequate warning is provided to the public so that public exposure to the potential hazards of electrofishing operations is avoided. Boats should be clearly marked with "Danger Electricity" signs.

(5) Shutting down electrical power should the public approach closer than 100 feet to electrofishing operations.

(6) Ensuring precautions are taken to avoid harm to domestic animals or wildlife.

(7) Ensuring that all electrofishing operations cease and all crew members go ashore in the event of severe weather such as electrical storms.

(8) Ensuring that only those persons necessary to conduct a safe and efficient operation engage in each electrofishing activity.

(8) Ensuring that at least one other member of the team is certified in CPR and first aid.

(9) Ensuring the availability of a well equipped, water-tight first aid kit.

(10) Providing safety orientation at least once per season to all crew members that either are not team leaders or have not completed the course *Principles and Techniques of Electrofishing*. Information must include but is not limited to that listed in 6.6C. All training will be documented.

(11) Fostering an environment wherein employees feel free to voice any safety concerns without fear of repercussions.

D. Employees are responsible for reporting all potential work hazards, accidents, incidents, and job related illnesses/injuries to their team leader supervisors immediately.

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6.5 What definitions are useful in understanding the requirements of this chapter?

A. Alternating Current (AC). Typically a sinusoidal waveform with reversing electrode polarity (the electrodes alternate between being an anode or cathode at the waveform frequency in Hertz or cycles per second).

B. Anode. The positive electrode for direct current (DC) or pulsed DC system.

C. Bonding. The permanent joining of metallic pairs to form an electrically conductive path, which assures electrical continuity, with the capacity to safely conduct current.

D. Branch Circuit. The circuit conductors between the final overcurrent device protecting the circuit and the electrical load(s).

E. Case Neutral. An electrical connection between the generator windings and the generator case (generator exterior).

F. Cathode. The negative electrode for DC or pulsed DC systems.

G. Circuit Breakers. A device that monitors the current and automatically opens the circuit when an overcurrent occurs.

H. Conductor. A device (wire, SO cable, SJ cable, etc.) that transmits electric charge.

I. Deadman Switch. A switch that is “normally open,” which requires constant pressure to supply electrical current to the circuit.

J. Direct current (DC). An electrical waveform that exhibits relatively constant or continuous current with no reversing electrode polarity.

K. Electrofishing. The use of electricity in water to capture or control fish or other aquatic organisms.

L. Electrofishing Team Leader. The onsite individual in charge of the electrofishing operation. Only persons demonstrating knowledge of the principles and techniques of electrofishing in accordance with paragraph 6.6 can serve as electrofishing team leaders.

M. Emergency stop switch. A switch that shuts off system power when pressure is applied. Activating an emergency stop switch is facilitated by “mushroom” or “slap-switch” style configurations.

N. Ground. A conducting connection, whether intentional or accidental, between an electrical circuit or equipment

and the earth or to some conducting body that serves in place of the earth.

O. Isolation Transformer. A transformer inserted into a system to separate one section of the system from undesired influences from other sections.

P. Netter. The individual who nets the fish or other aquatic organisms during electrofishing operations.

Q. Power Control Circuit. The circuit which interconnects and adjusts the power from the pulsator or generator to the electrodes.

R. Pulsator (control box). The device used to modify the pulsed electric current delivered from the power source.

S. Pulsed Direct Current (PDC). An electrical waveform formed by making regular interruptions in a continuous DC waveform.

T. RMS. “Root Mean Square”, designates effective or “average” alternating current (AC) voltage, amperage, or power.

U. Watertight. Constructed so that moisture will not enter the enclosure.

V. Weatherproof. Constructed or protected so that exposure to the weather will not interfere with safe operation.

6.6 What are the training requirements for Team Leaders and other crew members?

A. Team leader certification will consist of items (1), (2), and (3) below.

(1) Successful completion of the NCTC course *Principles and Techniques of Electrofishing* (classroom or correspondence version). Course topics include:

(a) The basic principles of electricity and the generation of electric fields in water.

(b) The basic concept and design guidelines for electrofishing equipment.

(c) Electrofishing equipment, the equipment's capabilities, limitations, and safety features.

(d) The safety precautions to employ while using electrofishing equipment.

(e) Awareness of and methods to reduce fish trauma due to electrofishing.

(2) The team leader must retake and successfully complete the course (classroom or correspondence version) every 5 years.

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(3) The team leader must have a current certification in cardiopulmonary resuscitation (CPR) training and first aid. A certificate from the Red Cross or other recognized institution will certify CPR and first aid training.

B. At least two members total of an electrofishing team will hold a current certificate in CPR and first aid.

C. All members of the electrofishing crew will be trained by a team leader in the following areas:

(1) Overview of electrofishing equipment components and procedures.

(2) Hazards involved in electrofishing.

(3) Safe operation of electrofishing equipment.

D. Personnel operating any motorized watercraft in the line of duty must complete the Department of the Interior Motorboat Operators Certification Course.

6.7 What electrical specifications are applicable to all electrofishing gear types?

A. Case Neutral Removal. Alternating current (AC) voltage from the generator will be isolated from the ground either by removing the neutral connection from within the generator or by incorporating an isolation transformer. **WARNING:** A generator with the case neutral removed cannot be used for land-based, non-electrofishing operations unless the case neutral is reconnected.

B. Conductor Voltage. Insulation of the conductors within an electrofishing system must accommodate RMS voltages generated by the power source and pulsator without breakdown. For equipment that generates a maximum of 1,000 V_{RMS}, conductor insulation rated at 600 V_{RMS} is sufficient. For systems generating a maximum of 300 V_{RMS}, conductors with insulation rated at 300 V_{RMS} may be used instead.

C. Conductor Size. Conductor size (i.e., current carrying wire) will be approved for rated RMS amperage of equipment as follows:

Maximum Amperage	Minimum Conductor Size
10	16 AWG
15	14 AWG
20	12 AWG
30	10 AWG
AWG = American Wire Gauge	

D. Conductor Placement. All conductors will be enclosed in watertight, rigid or flexible conduits or appropriate heavy-duty rubber insulated cables.

E. Connections.

(1) When using conduit, splices in wiring are only permitted in condulets or junction boxes. If connections are necessary, the rating of the connector must be the same or greater than the wire.

(2) Connectors used in association with flexible cables will be of the locking, watertight type. The connection to the generator should be protected by a splash cover (e.g., a rubber hood).

(3) All equipment must be turned off before making any connections, or replacing parts, or performing repairs.

F. Condulets and Junction Boxes. All condulets and junction boxes must be weatherproof.

G. Circuit Breakers.

(1) The electrofishing system (e.g., generator, pulsator, or console) will include circuit breakers or fuses to provide circuit protection.

(2) If external to the generator or pulsator, circuit breakers or fuses used for providing branch circuit protection should be labeled as to purpose.

H. Controls for Electrical Equipment.

(1) An on-off switch must be readily available on the generator power source and pulsator. It is recommended that either the pulsator or generator be equipped with a mushroom, push-button, or slap style emergency stop switch to speed system shut-down.

(2) It is recommended that amperage and voltage meters be installed to monitor power delivered to the electrodes.

(3) Power control (safety) circuits will be low voltage and not exceed 24 volts.

I. Gloves.

(1) All team members will wear rubber gloves of sufficient length to isolate hands from external surfaces. Never touch both electrodes simultaneously while power source is running. The following are dielectric strengths (volts per mil thickness) of four materials per ASTM method D-149-75:

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Neoprene	600 volts/mil
Polyurethane	330 volts/mil
PVC	250 volts/mil
Silicone	100 volts/mil

(2) Note that when a range of voltages was listed by ASTM, the lowest voltage per millimeter (mil) thickness was used. In addition, without periodic testing with specialized equipment, you cannot be sure of the dielectric strength of your gloves.

(3) Gloves will be visually inspected for punctures before each use and will be replaced if tears or punctures are evident.

J. Polarized sunglasses. Polarized sunglasses should be worn when there is glare.

K. Net Handles. Net handles will be constructed of a nonconductive material and will be of sufficient length to avoid hand contact with the water.

L. Noise.

(1) When crew members are subjected to sound exceeding those listed in the following table, we will provide personal protective equipment which must be used to reduce sound levels within the levels noted (OSHA Noise Level Standard, 29 CFR 1910.95).

Duration Per Day (Hours)	Sound Level dBA Slow Response
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

(2) Personal protective measures, such as use of earplugs, are described in 242 FW 3. The purchase of 2-way communication headphones is authorized through station funding. This type of headphone, to be effective, should reduce generator and motor noise significantly and

provide clear communication between the netter and the equipment operator.

M. Exhaust From Power Source. The exhaust from gasoline powered engines will be directed away from the equipment operator. Exposed hot pipes will be enclosed in protective screening to reduce the potential of burn exposure to crew members. The use of galvanized pipe for exhaust is discouraged due to the potential release of toxic gases that are produced under extreme heating conditions.

N. Fuel Storage. Gasoline will be stored and transported in containers designed for fuel storage. Plastic containers instead of metal are recommended.

O. Refueling.

(1) To refuel the generator, all equipment will be turned off. Hot surfaces will be allowed to cool. It is recommended that all tanks be filled prior to each operation to avoid the potential for explosion or fire while refueling. No flames or smoking allowed during refueling.

(2) Gasoline refueling must not take place on a plastic surface (e.g., a plastic lined pick-up truck bed).

P. Equipment Inspection. All external wiring, cables, and connectors will be visually inspected for physical damage or corrosion before each use. Any equipment deficiency that may present a safety hazard will be corrected before each field operation or when equipment damage occurs during actual use.

6.8 What electrical specifications are applicable to portable electroshockers (backpack, tow barge, shore-based, prepositioned, etc.)?

A. General.

(1) Electrodes.

(a) Electrode handles will be constructed of a nonconductive material and be long enough to avoid hand contact with the water.

(b) The positive electrode (anode) used with portable electroshockers will be equipped with a manually operated, normally open switch that breaks the electric current upon release. Do not bypass the manual switches with hold-down mechanisms (e.g., tape).

(2) Standard Safety Equipment.

(a) All crew members will wear chest or hip waders to insulate the wearer from electrical shock. Suitable waders are generally constructed of neoprene, PVC, silicon, etc. Breathable, lightweight waders may not

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have adequate electrical insulating properties. All footwear will be equipped with non-slip soles.

(b) All persons will wear U.S. Coast Guard approved personal flotation devices (Type III minimum) when working in waters that are deep or deep and swift.

B. Backpack Electrofishing Units.

(1) Batteries used as an electrical power source will be of the gel type that will not leak when tipped or overturned.

(2) Backpacks will be equipped with a quick release belt (hip) and shoulder straps.

(3) All equipment must be equipped with a tilt switch that opens the circuit if the operator falls. The switch must be a type that has to be manually reset after the operator has regained his/her footing.

(4) No netting will be used on the hand-held electrodes except when sampling for lamprey ammocetes or when the unit is equipped with a automatic shut-off switch that opens the circuit when an electrode is out of the water.

C. Shore-based Electrofishing Units.

(1) Each electrode operator must have an individual activation switch.

(2) The generator must be manned to provide immediate shutdown in case of an emergency.

D. Tow-Barge Electrofishing Units.

(1) Each electrode operator must have an individual activation switch.

(2) The barge hull must be made of nonconductive material with the electrode attached to the hull bottom.

(3) The generator must be manned to provide immediate shutdown in case of an emergency.

(4) The tow barge operator must have a deadman switch that would stop the electrical power if the operator fell away from the barge.

E. Electric Seine Electrofishing Units.

(1) Each braille (seine pole) must have an individual activation switch wired in series to control the power applied to the electrodes.

(2) The generator must be manned to provide immediate shutdown in case of an emergency.

F. Prepositioned Area Electrofishing Units. The generator must be manned to provide immediate shutdown in case of an emergency.

6.9 What specifications are applicable to eletrofishing boats?

A. Design.

(1) Boat design and equipment must be in compliance with U. S. Coast Guard, State, and U. S. Department of the Interior regulations and follow the additional guidelines in paragraph 6.7.

(2) The boat bow deck will be painted with a nonslip or skid-resistant coating or roughened in some manner to lower the possibility of slipping.

(3) Anodes will be mounted in a fixed position.

B. Clear Working Space. General boat housekeeping must provide adequate working space to conduct safe operations. Care will be exercised to prevent clutter that may result in safety hazards.

C. Boat Inspection. The boat and equipment will be visually inspected for safety by the supervisor or operator in charge, prior to each use. Significant deficiencies, which could result in employee injury, will be corrected prior to operation or use of the equipment.

D. Controls for Electrical Equipment.

(1) The boat operator must have ready access to a on/off, emergency stop, or deadman switch to cut the power in case of an accident.

(2) A minimum of one netter on the bow work deck will have a deadman switch connected to the power control circuit.

E. Grounding/Bonding. All metal surfaces within a boat will be electrically connected (i.e., in electrical continuity) to eliminate differences in electrical potential that may result in electric shock. Metal boat hulls also may be used as a cathode.

F. Battery Enclosure. An acid proof, nonmetallic enclosure and holder will be provided for wet cell batteries.

G. Conductor Protection. All conductors will be enclosed in watertight, flexible or rigid conduits. Appropriately rated, heavy duty insulated cables can be used where external connections are necessary (e.g., to the booms, pulsator, or deadman switch). All conductors installed in a common raceway (conduit) must be continuous (without connectors, breaks, or splicing) and independently and correctly insulated. All

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low voltage (24 volts or less) circuit conductors will be in 300 V_{RMS} minimum cable if contained in the same conduit as the high voltage conductors.

H. Auxiliary Circuits. Lighting and other auxiliary circuits should not exceed 24 volts. However, 110 volt lamps may be used if the lamp is shielded with a protective housing.

I. Lighting.

(1) When the boat is operated at night, adequate on-board lighting (12-24 volts) will be provided for working areas.

(2) Adequate lighting will be provided while electrofishing to avoid safety hazards such as striking logs, rocks, and overhead tree branches.

J. Safety Rails. Substantial safety rails will be provided around the outside of the netting area. Rails will be designed to withstand a 200 pound (90 kilogram) thrust.

K. Fire extinguishers. Mount fire extinguishers away from gas cans, generators, or other fire sources.

L. Refueling. Portable fuel tanks must be removed from the boat for refilling.

M. Standard Safety Equipment.

(1) All occupants will wear U.S. Coast Guard approved personal flotation devices at all times in accordance with the Department of the Interior watercraft safety policy, 485 DM 22, and the Service watercraft safety policy, 241 FW 1.

(2) A minimum of knee high rubber boots will be worn by all crew members to protect against electric shock.